

Amendments to the Specification

Please replace paragraph [009] with the following paragraph:

[009] In another aspect thereof, the present invention further fulfills the foregoing needs by providing an article cleaning apparatus including an air management mechanism, a cleaning basket assembly, and a fluid regeneration device. A working fluid device is coupled to the fluid regeneration device, the cleaning basket assembly and the air management mechanism. A clean fluid device is coupled to the cleaning basket assembly and the fluid regeneration device. The controller is coupled to the air management mechanism, the cleaning basket assembly, the working fluid device, the fluid regeneration device, and the clean fluid device. The controller is configured to control a cleaning process including at least a solvent cleaning process that utilizes a solvent based cleaning fluid comprising cyclic siloxane solvent. A solvent contaminant detection device is coupled to the fluid regeneration device to determine an amount of solvent contaminant that may accumulate in the solvent.

Please replace paragraph [035] with the following paragraph:

[035] The present invention includes an apparatus and method for the cleaning of articles at home or in a coin-op laundry setting. As used herein, the term, "articles" is defined, for illustrative purposes and without limitation, as fabrics, textiles, garments, and linens and any combination thereof. As used herein, the term, "solvent based cleaning fluid" is defined for illustrative purposes and without limitation, as comprising a cyclic siloxane solvent and, optionally, a cleaning agent. If water is present in a solvent based cleaning fluid, the water is present in an amount in a range from about 0.25 percent to about 10 percent of the total weight of the solvent based cleaning fluid. In another embodiment of the present invention, if water is present in the solvent based cleaning fluid, the water is present in an amount in a range from about 0.25 percent to about 2 percent of the total weight of the solvent based cleaning fluid. As used herein,

the term, "cleaning agent" is defined for illustrative purposes and without limitation, as being selected from the group consisting of sanitizing agents, emulsifiers, surfactants, detergents, bleaches, softeners, and combinations thereof. As used herein, the term, "water based cleaning fluid" is defined for illustrative purposes and without limitation, as comprising water and, optionally, a cleaning agent. In the present invention, the article cleaning apparatus 1000 of Fig. 1 is configured to perform a cleaning process 350 of Fig. 11. As used herein, the term, "cleaning process" is defined, for illustrative purposes and without limitation, as utilizing a solvent cleaning process 375, a water cleaning process 600, and any combination thereof. The solvent cleaning process 375 and the water cleaning process 600 are presented in more detail after the ~~article~~ description of the article cleaning apparatus 1000 of Fig. 1. It is recognized that alternative configurations of the article cleaning apparatus 1000 are possible.

Please replace paragraph [043] with the following paragraph:

[043] The fluid regeneration device 7 comprises a regeneration cartridge 141. The inlet side of the regeneration cartridge 141 is typically coupled to the working fluid device 6. The regeneration cartridge 141 typically comprises at least a water ~~adsorption~~absorption media 130 coupled to a cleaning fluid regeneration ~~adsorption~~absorption media 135. In one embodiment of the present invention, the regeneration cartridge 141 further comprises a mechanical filter 120 and a particulate filter 125. In one embodiment of the present invention, the working fluid 165 passes sequentially through the mechanical filter 120, particulate filter 125, water ~~adsorption~~absorption media 130, and cleaning fluid regeneration ~~adsorption~~absorption media 135. The cleaning fluid regeneration adsorption media 135 contains a portion of the solvent based cleaning fluid 30 in order to replenish the solvent based cleaning fluid 30 that is consumed during the solvent wash/dry process 500 of Fig. 13. The cleaning fluid regeneration adsorption media 135 also contains a replacement amount of solvent based cleaning fluid 30 which is disposed of when changing out the regeneration cartridge 141.

Please replace paragraph [048] with the following paragraph:

[048] In another embodiment of the present invention, the mechanical filter 120 of Fig. 4 and the particulate filter 125 are disposed in the drain conduit 70 between the check valve 40 and the working tank 45. In an alternative embodiment of the present invention, the mechanical filter 120 is disposed in the drain conduit 70, while the particulate filter 125 is disposed in the regeneration cartridge 141. In another embodiment of the present invention, the mechanical filter 120 is not present and the particulate filter 125 is disposed in the regeneration cartridge filter 141. In another embodiment of the present invention, the mechanical filter 120 is not present and the particulate filter 125 is disposed in the drain conduit ~~70~~141. Both the arrangement of the internals of the regeneration cartridge 141 and the location and application of the mechanical filter 120 and the particulate filter 125 are provided for illustrative purposes and are not intended to imply a restriction on the present invention.

Please replace paragraph [053] with the following paragraph:

[053] In view of the foregoing considerations, aspects of the present invention are directed to using a suitable electromagnetic solvent contamination detector, such as an infrared (IR) or ultraviolet (UV) detector, in lieu of or in combination with the turbidity sensor, for detecting the amount of dissolved contaminants, such as fatty acids and esters, that may be present in the solvent, so that when a predetermined concentration of contaminants is attained, as measured by the detector, then the regeneration cartridge 141 (FIG. 2) or the ~~adsorption~~absorption media 135 (Fig. 2) in the regeneration cartridge 141 may be replaced. In this manner, a user would replace the ~~adsorption~~absorption media when truly necessary and would avoid the possibility of using solvent that is not purified, thereby reducing operational costs as well as improving wash quality to the appliance.

Please replace paragraph [068] with the following paragraph:

[068] Various contaminant concentrations are listed in Table 2. Contaminant feed concentration is the amount of contaminant determined in the cleaning fluid after each wash and contaminant product concentration is the amount measured after the solvent was processed through the adsorption column. "Soil/load additional" is the amount of contaminant added to the solvent from that individual wash and "soil/load cleaned" is that amount cleaned or the difference between the amount fed and the amount in the product. The feed and product contaminant concentrations, i.e. before and after adsorption processing, are plotted in Fig. 21. Samples analyzed by UV-Vis spectroscopy (e.g., 223 nm), show a monotonic increase and correlate to the amount of contaminant present. This is the basis for the on-line contaminant detection device to determine when to change the ~~adsorption~~absorption media. After approximately 43 loads the column required replacing. This is evident in ~~Fig~~FIG. 21 where concentrations of contaminant in the feed and product streams converge approximately at load 43 indicating that contaminant is no longer adsorbed. This occurred at a contaminant concentration of approximately 1400 ppm. Accordingly, in one exemplary embodiment, the UV absorbance corresponding to approximately 1400 ppm of contaminant might be the upper limit of contaminant and a light or any other suitable indication would come on indicating to the consumer to replace the adsorption filter.

Please replace paragraph [070] with the following paragraph:

[070] In Example 2 the data corresponds to an on-line detector affixed to the dry cleaning appliance to obtain feedback information essentially in real time with respect to the solvent purity and adsorption efficiency. A UV source, detector, and flow-through cell with suitable fiber optic connectors, e.g., commercially available from Ocean Optics, was purchased and installed on a washer prototype. Reference standard samples were made up as described above, and were injected into the flow cell. UV data was scanned and recorded as shown in Fig. 22. A relatively small ~~adsorption~~absorption media (e.g., about 400 gms carbon) was used for this experiment. Washes were performed as described in

example 1 above. After each wash, a stream of purified solvent was directed to the flow cell and the resulting UV spectrum was recorded. Fig. 23 shows the spectra for washes 1, 5, 9, and 15. After wash 15 the effluent solvent comprised approximately 1000 ppm of contaminants, a maximum level of acceptable soil chosen for this experiment and the carbon cartridge was replaced. It is contemplated that in a production appliance an indicator light may be wired to the detector to be turned on at a predetermined absorbance corresponding to a contaminant level that would indicate time for cartridge or adsorption media replacement.

Please replace paragraph [071] with the following paragraph:

[071] As will be appreciated by those skilled in the art, there are a number of possible configurations for the adsorption cartridges and the placement of one or more detectors. Multiple adsorption cartridges may be possible, placed in series or in parallel, and one or more detectors may be used for the purpose of monitoring solvent contamination. By way of example, one design, as described in Examples 1 and 2 above, is to just employ one detector after a single cartridge. A second arrangement, shown in Fig. 24, contemplates use of two cartridges, such as cartridges 702 and 704, with the detector 601 placed between them. In this fashion when the upstream cartridge (e.g., cartridge 702) becomes saturated, as indicated by detector 601, this cartridge is replaced and the second cartridge (e.g., cartridge 704) is swapped to be first in the series circuit. A new cartridge 706 would then be placed to be the second cartridge in the series circuit. This exemplary design may allow for full saturation of the first cartridge while still catching contaminant in the second cartridge that maybypasses the first cartridge.

Please replace paragraph [078] with the following paragraph:

[078] As shown in Fig. 6, in another embodiment of the present invention, the air management mechanism 1 further comprises a compressor 75, high-pressure

tubing 80, low-pressure tubing 85 and pressure reducing tubing 90 are disposed in a vapor compression cycle. As used herein, the term, "high-pressure tubing" is used to indicate that the high-pressure tubing is designed to contain a refrigerant 95 at a higher pressure than the "low-pressure tubing". The use of the terms "high-pressure tubing" and "low-pressure tubing" are used to express a relative pressure differential across the compressor 75. As used herein, the term, "pressure reducing tubing" is defined to indicate that the "pressure reducing tubing" comprises a flow restriction that is sufficient to provide the relative pressure differential at a junction between the "high-pressure tubing" and the "low-pressure tubing". The high-pressure tubing 80 of Fig. 6 is disposed from the compressor 75 to the heater 55. The pressure reducing tubing 90 is disposed between the heater 55 and the cooling coil 65. The low-pressure tubing 85 is disposed from the compressor 75 to the cooling coil 65. The refrigerant 95 is disposed to flow between the compressor 75, heater 55, and cooling coil 65.

Please replace paragraph [080] with the following paragraph:

[080] In another embodiment of the present invention, the air management mechanism 1 further comprises an auxiliary heater 158 of Fig. 6. The fan 50 is further disposed to provide airflow 53 through the auxiliary heater 158. Typically, the auxiliary heater 158, used in conjunction with the heater 55, provides a higher temperature in the airflow 53 that enters the cleaning basket assembly 2. The auxiliary heater 158 is disposed in the discharge ventilation ducting 52. In another embodiment of present invention, the auxiliary heater 158 is disposed in the suction discharge ventilation ducting 5153. Raising the air temperature of the airflow 53 typically decreases the drying time for the articles in the humidity sensing process 400 of Fig. 12 and the solvent wash/dry process 500 of Fig. 13.

Please replace paragraph [087] with the following paragraph:

[087] Additionally, in one embodiment of the present invention, the regeneration cartridge 141 of Fig. 2 further comprises a leak proof double inlet valves

assembly 101 and a leak proof double outlet valves assembly 106 to minimize the operator's contact with the solvent based cleaning fluid 30. In another embodiment of the present invention, the regeneration cartridge 141 (not shown in Fig. 2) further comprises a leak proof single inlet valve assembly ~~400~~ and a leak proof single outlet valve assembly ~~405~~ to minimize the operator's contact with the solvent based cleaning fluid 30. As used herein, the term, "leak proof" is defined to mean that there is no leakage of the solvent based cleaning fluid 30 beyond about 1 ml evident at 1) either end of the regeneration cartridge 141 after removal and 2) the connection points where the regeneration cartridge 141 installs into the fluid regeneration device 7.

Please replace paragraph [094] with the following paragraph:

[094] In one embodiment of the present invention, a process selection 310 of Fig. 11 occurs at the operator interface 190 and provides inputs to the controller 5 of Fig. 7. The operator selects between the cleaning process 350 of Fig. 11 and a drying process 360. This drying process 360 refers to the drying of articles after completing the water based cleaning process 600 of Fig. 14. When the operator selects the cleaning process 350 of Fig. 11, the operator then further chooses between performing either the solvent cleaning process 375 or the water cleaning process 600. In the present invention, the solvent cleaning process 375 of Fig. 11 is defined to include performing the humidity sensing process 400 and the subsequent solvent wash/dry process 500. Conversely, when the operator selects the drying process 360, a basket drying process 700 is performed. In one embodiment of the present invention, the operator has the option to select an additional solvent wash process as part of the solvent wash/dry process 500. The additional solvent wash process is typically used in conjunction with utilizing the solvent based cleaning fluid 30 that comprises cleaning agents. The additional solvent wash process typically improves the removal of the cleaning agents from the articles that remain after initially completing step 540 as detailed below. In another embodiment of the present invention, the operator has the option to select an additional rinse process 675

as part of the water cleaning process 600. In another embodiment of the present invention, when the operator selects the drying process 360 the operator is provided with a further option of selecting from either the basket drying process 700 or a timed basket drying process 705.

Please replace paragraph [095] with the following paragraph:

[095] The start of the solvent based cleaning cycle 375 of Fig. 11 starts with the controller 5 of Fig. 7 sensing the humidity in the rotating basket 14 of Fig. 8 by initiating the humidity sensing process 400 of Fig. 12. The start 410 of the humidity sensing process 400 initially begins by verifying that the door lock 19 is locked. A starting humidity in the rotating basket 14 of Fig. 8 is determined in the sensing humidity step 420 of Fig. 12 by the basket humidity sensor 173. The controller 5 of Fig. 7 then tumbles the rotating basket 14 in step 430 of Fig. 12. The airflow 53 of Fig. 5 is heated and passed through the air management mechanism 1 and the cleaning basket assembly 2 while tumbling the rotating basket 14 for a predetermined pre-drying time in step 440 of Fig. 12. The moisture in the rotating basket 14 becomes vapor. The airflow 53 containing the vapor comes out of the rotating basket 14 through the holes 17 of Fig. 8 and then passes through the lint filter 60. The airflow 53 of Fig. 5 subsequently passes over the cooling coil 65 where the vapor condenses to form condensate. The rotating basket 14 is tumbled and the airflow 53 entering the cleaning basket assembly 2 is heated for the predetermined amount of time in step 450. The controller 5 of Fig. 7 then determines a finishing humidity in the rotating basket 14 of Fig. 8. If the controller 5 of Fig. 7 determines that the finishing humidity is too high in step 460, then the controller 5 of Fig. 7 sends a warning in step 470 of Fig. 12 to the operator at the display panel 200 indicating that it may take longer to complete the solvent cleaning process 375 and a longer humidity sensing process 400 is initiated. The solvent wash/dry process 500 of Fig. 13 starts in step 480.

Please replace paragraph [097] with the following paragraph:

[097] Detection of solvent vapor in the rotating basket 14 of Fig. 8 is determined in step 560 of Fig. 13. The controller 5 of Fig. 7 then tumbles the rotating basket 14 and raises the temperature of the airflow 53 of Fig. 5 in step 570 of Fig. 13. A substantial amount of the remaining portion of the solvent based cleaning fluid 30 and any liquid becomes vapor. The vapor flows from the rotating basket 14 through the lint filter 60 and passes over the cooling coil 65. The vapor condenses on the cooling coil 65 to form a condensate. The post-drying solvent vapor detection in the rotating basket 14 of Fig. 8 is determined in step 580 of Fig. 13. The process steps of 560 through 580 in Fig. 13 as detailed above are performed until the post-drying solvent vapor in the rotating basket 14 of Fig. 8 reaches an acceptable level, at which point the controller 5 of Fig. 7 unlocks the basket door 15 in step 590 of Fig. 13. In another embodiment of the present invention, the operator selects the additional solvent wash process. The additional solvent wash process comprises completing step 520, step 530, and step 540 and occurs after completing step 540 and before performing step 560, where the individual steps are as described above. In one embodiment of the present invention, the additional solvent wash process enhances the cleaning performance of especially soiled articles. In another embodiment of the present invention, the additional solvent wash process enhances the removal of cleaning agents. The operator selects the additional solvent wash process at the operator interface 190.

Please replace paragraph [105] with the following paragraph:

[105] The water cleaning process 600 begins with the initial conditions of the cleaning agents loaded into the dispenser 300, and the door lock 19 engaged and the door lock sensor 18 verifying that the basket door 15 is in the locked position at the start step 610 of Fig. 14. Water and cleaning agents are added to the rotating basket 14 to produce the water based cleaning fluid 31 of Fig. 9 in step 620. The water may be hot, cold or a mixture as detailed above. The rotating basket 14 is tumbled in step 630 of Fig. 14. Substantially all of the water based cleaning fluid 31 of Fig. 9 is spin extracted by rotating from the rotating

basket 14 of Fig. 2 in step 640 of Fig. 14. The controller 5 of Fig. 7 opens the water drain valve 260 of Fig. 2 and operates the regeneration pump 115 as necessary to drain the rotating basket 14 during the spin step 640, when the basket conductivity cell 170 of Fig. 8 detects that the water based cleaning fluid 31 of Fig. 9 in the rotating basket 14 comprises greater than about 10% water by weight. The controller 5 of Fig. 7 closes the water drain valve 260 of Fig. 2 after removing the water based cleaning fluid 31 of Fig. 9 from the rotating basket 14 of Fig. 2 after completing the spin basket step 640.

Please replace paragraph [108] with the following paragraph:

[108] In another embodiment of the present invention, the article cleaning apparatus 1000 of Fig. 1 is configured to perform the basket drying process 700 of Fig. 15. The basket drying process 700 of Fig. 15 is provided to illustrate the basket drying process 700 used in one embodiment of the present invention and in no way implies any limitation to the basket drying process 700 of the present invention. The basket drying process 700 begins with the initial conditions of the basket door 15 locked, and the door lock sensor 18 verifying the basket door 15 locked at the start step 710 of Fig. 15. The basket drying process 700 initially begins by performing a sensing humidity step 720 to determine a start humidity, a tumble basket step 730 and heat airflow step 740 similar to that described above in steps 420, 430, and 440, respectively. After tumbling and heating the airflow 53 for a predetermined post-water wash drying time in step 750, the controller 5 of Fig. 7 determines a final humidity in the rotating basket 14 of Fig. 8 in step 760. When the controller 5 of Fig. 7 determines that the final humidity is too high, then the controller 5 initiates a longer drying sequence in step 770~~760~~ by re-performing steps 730 through 760. When the final humidity is acceptable, the controller 5 of Fig. 7 stops the basket drying process 700 of Fig. 15 in step 770, and unlocks the basket door 15 of Fig. 8 in step 780 of Fig. 15.